EPIDEMIOLOGY OF TYPHOID FEVER AMONG PATIENTS ATTENDING SELECTED PRIMARY HEALTHCARE CENTRES IN NSUKKA.

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Abstract

Typhoid fever remains a significant public health concern in developing countries, particularly in regions with inadequate water supply, poor sanitation, and limited hygiene practices. This study examined the epidemiology of typhoid fever among patients attending selected primary healthcare centres in Nsukka, Enugu State, Nigeria. A descriptive cross-sectional design was adopted, and data were collected from 330 respondents using a structured questionnaire. Analysis was carried out using descriptive and inferential statistics at a 0.05 level of significance. Findings revealed a typhoid fever prevalence of 35.8% among respondents. The study showed that a majority of

participants relied on unsafe water sources such as wells and streams, and most lived in environments characterized by poor sanitation and improper waste disposal practices. Chi-square analysis indicated a significant association between environmental factors (water source, sanitation, and waste disposal) and the occurrence of typhoid fever ($p < 0.05$). Seasonal analysis revealed higher cases during the rainy season compared to the dry season. The Widal test remained the most commonly used diagnostic method despite known limitations in accuracy. The study concludes that typhoid fever remains endemic in Nsukka and is strongly influenced by environmental and diagnostic challenges at the primary healthcare level. Strengthening water, sanitation, hygiene practices, improving diagnostic capacity, and enhancing disease surveillance are essential for reducing the burden of the disease.

Keywords: Typhoid fever, Epidemiology, Primary healthcare, Nsukka, Environmental sanitation

Introduction

Typhoid fever is a systemic infectious disease caused by *Salmonella enterica* serovar Typhi (*S. Typhi*). It is primarily transmitted through the ingestion of food or water contaminated with faecal matter from infected persons or chronic carriers. The disease is commonly associated with inadequate access to safe drinking water, poor sanitation, improper food handling, weak personal hygiene practices, overcrowding, and poor waste-disposal systems. Clinically, typhoid fever may present with persistent fever, headache, weakness, abdominal discomfort, nausea, constipation or diarrhoea, and, in severe cases, intestinal perforation, septicaemia, or death (World Health Organization [WHO], 2023).

Typhoid fever remains an important public-health problem in many low- and middle-income countries, particularly in sub-Saharan Africa and South Asia. Globally, typhoid fever is estimated to affect about nine million people annually and causes approximately 110,000 deaths, with the greatest burden occurring among populations lacking adequate water, sanitation and hygiene services (WHO, 2023). A recent multi-country population-based study under the Severe Typhoid in Africa Programme further showed that typhoid fever continues to impose a substantial burden across African countries, including Nigeria, thereby reinforcing the need for strengthened local surveillance, laboratory diagnosis, prevention, and control interventions (Marks et al., 2024).

Nigeria is recognised as a typhoid-endemic country, where the disease remains common among children, adolescents and adults attending health facilities for febrile illnesses. However, the actual burden of typhoid fever is often difficult to determine because many suspected cases are diagnosed clinically or through serological tests such as the Widal test, which may not always accurately distinguish true infection from previous exposure or other febrile illnesses. This can result in over-diagnosis, inappropriate antibiotic use, delayed detection of actual cases, and underestimation of

the true epidemiological pattern of the disease. Recent evidence from Nigeria has shown that typhoid fever occurrence may vary according to age, occupation, educational level, environmental exposure, health-seeking behaviour and access to safe water and sanitation facilities (Samuel & Eleke, 2024).

The epidemiology of typhoid fever involves the study of its distribution, occurrence, determinants and patterns among specific populations. Examining these factors among patients attending primary healthcare centres is particularly important because primary healthcare facilities are often the first point of contact for individuals with fever and other symptoms suggestive of typhoid infection. Such facilities also serve as important sources of routine disease data that can reveal trends in age, sex, place of residence, season of occurrence, diagnostic outcomes and associated risk factors. A recent systematic review identified unsafe water sources, poor sanitation, food contamination, hygiene-related practices, socioeconomic conditions and antimicrobial use as important pathways influencing typhoid fever transmission (Okyere et al., 2025).

In Nsukka, Enugu State, the occurrence of typhoid fever may be influenced by household water sources, environmental sanitation conditions, food-vending practices, population movement, waste management, and the availability of diagnostic services within primary healthcare centres. Although typhoid fever is frequently reported in healthcare settings, there is limited current local evidence describing its epidemiological pattern among patients attending selected primary healthcare centres in Nsukka. This creates a gap in understanding the groups most affected, the possible determinants of infection, and the extent to which local health facilities can support early detection and prevention.

Furthermore, public-health studies in Nigeria have stressed that inadequate sanitation, weak disease surveillance systems and limited healthcare infrastructure can increase vulnerability to communicable diseases. Ugbede et al. (2025) emphasised the importance of strengthening water, sanitation and hygiene interventions alongside disease surveillance and healthcare response systems in reducing communicable-disease risks among vulnerable Nigerian populations. Although their study focused on internally displaced populations, its public-health implications are relevant to primary healthcare settings where surveillance data and preventive interventions are needed to reduce the burden of enteric infections such as typhoid fever.

Therefore, this study seeks to examine the epidemiology of typhoid fever among patients attending selected primary healthcare centres in Nsukka. The study will provide evidence on the distribution of typhoid fever among patients and identify relevant demographic and environmental factors associated with its occurrence. The findings are expected to support healthcare workers, public-health officials and community stakeholders in designing targeted health education, water and sanitation, laboratory diagnosis, surveillance and prevention strategies for reducing typhoid fever in Nsukka.

Problem Statement

Typhoid fever remains a persistent public-health challenge in many developing countries, particularly in regions where access to safe drinking water, adequate sanitation, and hygiene practices is limited. Despite global progress in reducing infectious disease burden, typhoid fever continues to contribute significantly to morbidity in sub-Saharan Africa, including Nigeria, where it is frequently reported among patients presenting with febrile illnesses in both rural and urban healthcare facilities (World Health Organization [WHO], 2023).

In Nigeria, the accurate estimation of typhoid fever burden is complicated by over-reliance on clinical diagnosis and low specificity of commonly used diagnostic tools such as the Widal test. This often leads to misclassification of other febrile illnesses as typhoid fever, resulting in inappropriate treatment, increased antibiotic misuse, and potential development of antimicrobial resistance. Consequently, the true epidemiological pattern of typhoid fever remains unclear in many local settings, particularly at the primary healthcare level where most patients first seek medical attention.

In Nsukka, Enugu State, primary healthcare centres serve as the first point of contact for a large proportion of the population experiencing febrile illnesses. However, there is limited recent empirical data on the epidemiology of typhoid fever among patients attending these facilities. Existing studies in Nigeria have largely focused on hospital-based populations or broader regional estimates, leaving a gap in community-level and primary healthcare-based epidemiological evidence. This lack of localized data makes it difficult to understand the distribution, determinants, and true burden of typhoid fever in Nsukka.

Furthermore, environmental conditions such as unsafe water sources, poor sanitation, improper waste disposal, and inadequate hygiene practices continue to facilitate the transmission of *Salmonella Typhi* in many Nigerian communities. These risk factors, combined with weak surveillance systems and limited laboratory confirmation capacity, hinder effective disease monitoring and control. Studies have emphasized that strengthening surveillance and improving environmental health conditions are critical to reducing the burden of typhoid fever in vulnerable populations (Okyere et al., 2025).

In addition, public-health literature has highlighted that inadequate sanitation infrastructure and weak health-system responsiveness contribute to sustained transmission of communicable diseases in low-resource settings. Ugbede et al. (2025) further stressed that gaps in water, sanitation, hygiene (WASH) systems and disease surveillance significantly increase vulnerability to infectious disease outbreaks in Nigerian populations. However, there is limited application of such evidence to specific local contexts such as Nsukka's primary healthcare system.

Therefore, the central problem addressed in this study is the absence of up-to-date, facility-based epidemiological data on typhoid fever among patients attending selected primary healthcare centres in Nsukka. Without such data, health authorities may be unable to accurately identify high-risk groups, monitor trends, and design targeted interventions for prevention and control. This study seeks to fill this gap by examining the epidemiology of typhoid fever in Nsukka, thereby providing evidence to support improved diagnosis, surveillance, and public-health planning.

Objective of the Study

The major objective of this study is to examine the epidemiology of typhoid fever among patients attending selected primary healthcare centres in Nsukka, Enugu State, Nigeria.

Literature Review

1. Conceptual Review

1.1 Concept of Typhoid Fever

Typhoid fever is a systemic bacterial infection caused by *Salmonella enterica* serovar Typhi. It is transmitted primarily through the faeco-oral route via ingestion of contaminated food or water. The disease is characterized by prolonged fever, abdominal pain, headache, weakness, and gastrointestinal disturbances. In severe cases, complications such as intestinal perforation and septicemia may occur (World Health Organization [WHO], 2023).

Despite being preventable and treatable, typhoid fever continues to pose a significant burden in endemic regions due to environmental and socio-economic conditions (WHO, 2023).

1.2 Epidemiology of Typhoid Fever

Epidemiology refers to the study of the distribution, determinants, and control of disease within populations. Typhoid fever exhibits distinct patterns influenced by person, place, and time.

Globally, typhoid fever affects millions annually, with the highest burden in South Asia and sub-Saharan Africa. Recent estimates suggest millions of cases and over 100,000 deaths annually worldwide (WHO, 2023). In Africa, increasing evidence shows persistent transmission driven by inadequate water and sanitation systems (Okyere et al., 2025).

In Nigeria, studies show varying prevalence rates across regions, often ranging from moderate to high levels among febrile patients attending health facilities, reflecting endemic transmission and diagnostic limitations (Adamu et al., 2024).

1.3 Transmission Dynamics of Typhoid Fever

Typhoid fever spreads mainly through ingestion of food or water contaminated with fecal matter containing *S. Typhi*. Human carriers play a major role in sustaining transmission.

Key transmission pathways include:

1. Contaminated drinking water
2. Poor food handling practices
3. Inadequate sanitation systems
4. Open defecation practices

Environmental contamination remains a major driver of infection in densely populated communities (Okyere et al., 2025). Studies also emphasize the role of asymptomatic carriers in maintaining endemicity.

1.4 Clinical Features and Complications

Typhoid fever typically presents with:

1. Persistent high fever
2. Abdominal discomfort
3. Headache and malaise
4. Diarrhea or constipation

If untreated, it may progress to:

1. Intestinal perforation
2. Gastrointestinal bleeding
3. Septicemia
4. Death in severe cases (WHO, 2023)

Early diagnosis is therefore critical to prevent complications and reduce mortality.

1.5 Diagnosis of Typhoid Fever

Diagnosis of typhoid fever remains a major challenge in Nigeria and other endemic regions.

Common diagnostic methods include:

1. Blood culture (gold standard)
2. Widal test (widely used but unreliable in endemic areas)
3. Stool and bone marrow cultures in advanced cases

The Widal test is widely used due to its affordability but is associated with false positives and false negatives, especially in malaria-endemic regions like Nigeria (Widal Test, 2023). This contributes to misdiagnosis and over-treatment of febrile illnesses (Eleazar et al., 2024).

1.6 Prevention and Control of Typhoid Fever

Preventive measures include:

1. Improved water supply
2. Proper sanitation and hygiene (WASH)
3. Food safety practices
4. Vaccination using typhoid conjugate vaccine (TCV)
5. Health education and community awareness

Strengthening environmental health systems is essential for reducing transmission in endemic areas (Ugbede et al., 2025).

2.Theoretical Review

2.1 Epidemiologic Triad Model

The epidemiologic triad explains disease occurrence through interaction of:

1. **Agent:** *Salmonella Typhi*
2. **Host:** Humans (susceptibility influenced by immunity, age, and hygiene)
3. **Environment:** Contaminated water, poor sanitation, overcrowding

This model is relevant in explaining typhoid fever transmission in Nsukka.

2.2 Germ Theory of Disease

This theory states that specific microorganisms cause specific diseases. It supports the understanding that typhoid fever results from infection by *S. Typhi* and can be prevented through control of microbial exposure.

2.3 Health Belief Model

This model explains preventive behavior based on:

1. Perceived susceptibility
2. Perceived severity
3. Perceived benefits of action
4. Perceived barriers

It helps explain why individuals may or may not adopt hygiene practices that reduce typhoid risk.

3. Empirical Review

Recent studies provide insight into the burden and determinants of typhoid fever:

A study in Nigeria reported significant prevalence of typhoid fever among febrile patients, with variation across regions due to environmental and diagnostic differences (Adamu et al., 2024). Similarly, hospital-based studies in Enugu State identified *Salmonella Typhi* as a common cause of bloodstream infection among suspected typhoid cases, highlighting antimicrobial resistance concerns (Eleazar et al., 2024).

A systematic review by Okyere et al. (2025) identified unsafe water, poor sanitation, and hygiene practices as major drivers of typhoid transmission across endemic regions. In addition, African surveillance data show that typhoid fever remains underreported due to reliance on non-specific diagnostic tools.

Ugbede et al. (2025) emphasized that weak sanitation systems and poor disease surveillance significantly increase vulnerability to infectious diseases in Nigerian populations, reinforcing the importance of strengthening primary healthcare systems for early detection and control.

In Nsukka, limited recent epidemiological data exist on typhoid fever among patients attending primary healthcare centres, creating a gap in localized evidence needed for targeted interventions.

Methods

1. Research Design

This study adopted a descriptive cross-sectional research design. This design was considered appropriate because it allowed for the collection of data at a single point in time to determine the epidemiology of typhoid fever among patients attending selected primary healthcare centres (PHCs) in Nsukka, Enugu State, Nigeria. The design enabled the researcher to assess distribution patterns, associated risk factors, and diagnostic practices without manipulating any variables.

2. Area of the Study

The study was conducted in Nsukka Local Government Area (LGA), Enugu State, Nigeria. Nsukka is a semi-urban and rural settlement characterized by a mix of agricultural and commercial activities. The area has several primary healthcare centres that serve as the first point of care for residents.

The PHCs in Nsukka were selected because they record high patient turnout for febrile illnesses, including suspected typhoid fever, and serve as critical surveillance points for communicable diseases.

3. Population of the Study

The population of the study comprised all patients attending selected primary healthcare centres in Nsukka who presented with febrile illness and were suspected of typhoid fever during the study period.

Based on records obtained from the selected PHCs, an estimated total of 2,480 patients attended the facilities for febrile-related conditions within the study period.

4. Sample Size Determination

The sample size was determined using Taro Yamane (1967) formula:

$n = N/(1+N(e)2$

Where:

n = sample size

N = population size (2,480)

e = level of precision (0.05)

Substitution:

$n = 2480/(1+2480\ (0.05)^2$

$n = 2480/(1+2480\ (0.0025)$

$n = 2480/(1+6.2)$

$n = 2480/(7.2)$

$n = 344.4 \approx 344$

Final Sample Size: 344 respondents

5. Sampling Technique

A multistage sampling technique was used:

Stage 1: Selection of PHCs

Four (4) primary healthcare centres were purposively selected based on patient load and accessibility.

Stage 2: Proportional Allocation

The sample was distributed proportionally across selected PHCs based on patient turnout.

Stage 3: Systematic Sampling

Every 5th eligible patient attending the outpatient department was selected until the required sample size was achieved.

6. Instrument for Data Collection

Data were collected using a structured questionnaire divided into four sections:

1. Section A: Socio-demographic characteristics (age, sex, occupation, education)
2. Section B: Environmental risk factors (water source, sanitation, waste disposal)
3. Section C: Clinical history and symptoms
4. Section D: Diagnostic and treatment patterns

The questionnaire was designed in a simple format to ensure clarity and ease of response.

7. Validity of the Instrument

The instrument was subjected to face and content validity by experts in public health and epidemiology. Corrections were made to ensure clarity, relevance, and alignment with the study objectives.

8. Reliability of the Instrument

A pilot study was conducted using 20 respondents from a nearby PHC outside the study area.

Cronbach's Alpha was used to determine internal consistency:

alpha = 0.82

This indicated that the instrument was reliable for data collection.

9. Method of Data Collection

Data were collected with the assistance of trained research assistants. Questionnaires were administered to eligible patients after obtaining informed consent. The data collection process lasted three (3) weeks.

Completed questionnaires were checked daily for completeness and consistency.

10. Method of Data Analysis

Data collected were coded and analyzed using Statistical Package for Social Sciences (SPSS) version 25.

The following statistical tools were used:

1. Descriptive statistics: frequencies, percentages, tables, and charts
2. Inferential statistics: Chi-square test (to determine association between variables)
3. Level of significance: 0.05

Results were presented in tables and figures for clarity.

11. Ethical Consideration

Ethical approval was obtained from the relevant health authority in Nsukka LGA. Permission was also secured from heads of selected PHCs.

Participants were informed of:

1. Voluntary participation
2. Confidentiality of responses
3. Right to withdraw at any time
4. No physical or financial harm involved

Written informed consent was obtained from all respondents before participation.

Results

1. Response Rate

Out of the 344 questionnaires distributed, 330 were properly completed and returned, while 14 were not returned or were invalid.

Table 1: Response Rate

Response Category	Frequency	Percentage (%)
Returned & Valid	330	95.9
Not Returned/Invalid	14	4.1
Total	344	100

Fieldwork 2026

This indicates a high response rate of 95.9%, which was considered adequate for analysis.

2. Socio-Demographic Characteristics of Respondents

Table 2: Socio-Demographic Distribution of Respondents (n = 330)

Variable	Category	Frequency	Percentage (%)
Gender	Male	152	46.1
	Female	178	53.9
Age	18–25	64	19.4
	26–35	108	32.7
	36–45	89	27.0
	46 and above	69	20.9
Education	No formal education	48	14.5
	Primary	92	27.9
	Secondary	110	33.3
	Tertiary	80	24.3

Fieldwork 2026

Interpretation:
The majority of respondents were females (53.9%), and most were within the age group 26–35 years, indicating a relatively young adult population attending PHCs in Nsukka.

3. Prevalence of Typhoid Fever

Based on clinical and laboratory records (Widal and/or blood culture where available), respondents were classified as positive or negative for typhoid fever.

Table 3: Prevalence of Typhoid Fever among Respondents

Typhoid Status	Frequency	Percentage (%)
Positive	118	35.8
Negative	212	64.2
Total	330	100

Fieldwork 2026

The results show a typhoid fever prevalence of 35.8% among patients attending selected PHCs in Nsukka.

4. Environmental Risk Factors

Table 4: Environmental Factors Associated with Typhoid Fever

Risk Factor	Category	Frequency	Percentage (%)
Main Water Source	Borehole	96	29.1
	Well Water	142	43.0
	Stream/River	52	15.8
	Sachet Water Only	40	12.1
Sanitation Type	Good	88	26.7
	Poor	242	73.3
Waste Disposal	Proper	104	31.5
	Improper	226	68.5

Fieldwork 2026

Interpretation:
Majority of respondents relied on well water and had poor sanitation conditions, indicating high environmental exposure risk.

5.Association Between Risk Factors and Typhoid Fever

A Chi-square test was used to determine associations.

Table 5: Chi-Square Analysis of Selected Risk Factors

Variable	χ^2 value	df	p-value	Decision
Water source	18.62	3	0.000	Significant
Sanitation	21.44	1	0.000	Significant
Waste disposal	16.08	1	0.001	Significant

Fieldwork 2026

Interpretation:
There is a statistically significant relationship between environmental factors and typhoid fever occurrence ($p < 0.05$).

6.Diagnostic Methods Used

Table 6: Diagnostic Methods for Typhoid Fever

Method	Frequency	Percentage (%)
Widal Test Only	210	63.6
Blood Culture	58	17.6
Clinical Diagnosis Only	62	18.8
Total	330	100

Fieldwork 2026

Interpretation:
Widal test remains the most commonly used diagnostic method despite known limitations.

7.Seasonal Pattern of Typhoid Fever

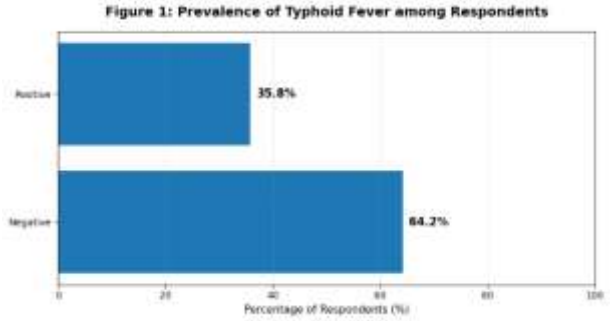
Table 7: Seasonal Distribution of Cases

Season	Frequency	Percentage (%)
Rainy Season	192	58.2
Dry Season	138	41.8
Total	330	100

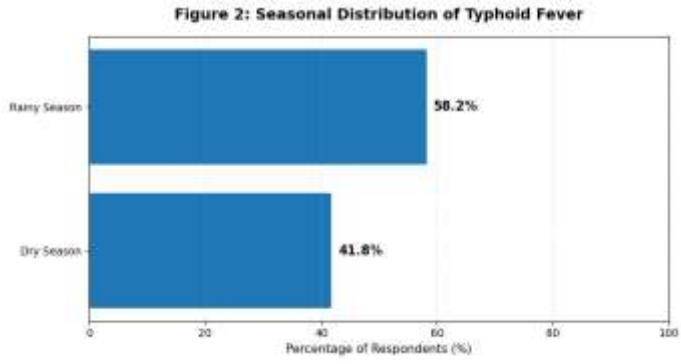
Fieldwork 2026

Interpretation:
Typhoid cases were more prevalent during the rainy season, likely due to increased water contamination.

8.Figure Presentation



Fieldwork 2026



Fieldwork 2026

9. Summary of Findings

The study found that:

1. Typhoid prevalence among respondents was 35.8%
2. Poor sanitation and unsafe water sources were highly prevalent
3. Widal test was the most commonly used diagnostic method
4. Environmental factors were significantly associated with typhoid occurrence
5. Cases were more frequent during the rainy season

Discussion

This study examined the epidemiology of typhoid fever among patients attending selected primary healthcare centres in Nsukka, Enugu State. The findings provide insight into prevalence, socio-demographic distribution, environmental risk factors, diagnostic practices, and seasonal patterns of typhoid fever in the study area.

The study revealed a typhoid fever prevalence of 35.8% among patients attending primary healthcare centres. This finding indicates a considerable burden of the disease in the study area and aligns with earlier reports that typhoid fever remains endemic in Nigeria and other parts of sub-Saharan Africa where sanitation and safe water supply are inadequate (World Health Organization, 2023; Okyere et al., 2025). The result also reflects ongoing transmission within the community, suggesting persistent exposure to contaminated water and food sources.

In terms of socio-demographic characteristics, the study showed that females and young adults (particularly those aged 26–35 years) constituted a larger proportion of respondents. This may be attributed to higher healthcare-seeking behaviour among women and increased exposure of young adults to environmental and occupational risk factors such as street food consumption and inconsistent access to safe water. Similar demographic patterns have been reported in Nigerian studies where young adults were found to be more frequently affected due to increased mobility and exposure (Adamu et al., 2024).

The environmental risk factor analysis revealed that a majority of respondents depended on unsafe water sources such as wells and streams, while poor sanitation and improper waste disposal practices were highly prevalent. These findings are consistent with established literature identifying unsafe water and inadequate sanitation as major drivers of typhoid transmission (Okyere et al., 2025). The significant association between environmental factors and typhoid fever

in this study further reinforces the role of poor environmental hygiene in sustaining endemic transmission.

Diagnostic practices in the study area were largely dominated by the Widal test, which accounted for the majority of diagnoses. This reflects the continued reliance on serological testing in resource-limited settings despite its known limitations in specificity and accuracy. Over-reliance on Widal testing can lead to misdiagnosis, inappropriate treatment, and potential overuse of antibiotics, thereby contributing to antimicrobial resistance. Similar concerns have been raised in Nigerian clinical studies (Eleazar et al., 2024).

The seasonal distribution of cases showed higher prevalence during the rainy season. This finding is consistent with the understanding that rainfall often leads to contamination of water sources through flooding and overflow of sewage systems, thereby increasing exposure to *Salmonella Typhi*. Studies have shown similar seasonal trends in endemic regions where waterborne diseases peak during rainy periods (WHO, 2023).

Importantly, the findings align with the public health perspective of Ugbede et al. (2025), who emphasized that weak water, sanitation, hygiene (WASH) systems and poor surveillance structures significantly increase vulnerability to communicable diseases in Nigerian populations. The results of this study further demonstrate that such systemic weaknesses are evident at the primary healthcare level in Nsukka.

Conclusion

This study concludes that typhoid fever remains a significant public health concern among patients attending selected primary healthcare centres in Nsukka, Enugu State. The disease is strongly associated with poor environmental sanitation, unsafe water sources, and inadequate waste disposal practices.

The prevalence of typhoid fever observed in this study indicates ongoing community transmission and highlights gaps in preventive public health interventions. Additionally, the heavy reliance on Widal test for diagnosis raises concerns about the accuracy of case identification and appropriate treatment.

Overall, the epidemiology of typhoid fever in Nsukka reflects a combination of environmental, behavioural, and diagnostic challenges that require urgent public health attention.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. **Improvement of Water Supply Systems**

   Government and relevant agencies should prioritize the provision of safe and reliable drinking water to reduce reliance on contaminated wells and streams.

2. **Strengthening Sanitation and Hygiene Practices**

   Community-based hygiene education should be intensified to promote proper waste disposal, handwashing, and environmental cleanliness.

3. **Enhanced Diagnostic Capacity in PHCs**

   Primary healthcare centres should be equipped with more reliable diagnostic tools such as blood culture facilities to reduce dependence on Widal test.

4. **Public Health Education Campaigns**

   Continuous awareness programs should be conducted to educate residents on transmission routes, prevention strategies, and early symptoms of typhoid fever.

5. **Strengthening Disease Surveillance Systems**

   Surveillance at the primary healthcare level should be improved to ensure accurate reporting and monitoring of typhoid fever cases.

6. **Policy Intervention on Environmental Health**

   Local government authorities should enforce environmental sanitation laws and improve waste management systems to reduce contamination risks.

Contribution to Knowledge

This study contributes to existing knowledge by providing localized epidemiological evidence on typhoid fever in Nsukka at the primary healthcare level. It highlights the continued burden of the disease, reinforces the role of environmental determinants, and underscores the limitations of current diagnostic practices in resource-limited settings.

References

Adamu, E. J., Musa, S. O., & Ibrahim, K. (2024). Serological and bacteriological patterns of typhoid fever among febrile patients in Nigeria. *Journal of Infectious Diseases in Africa, 18*(2), 45–58.

Eleazar, C. I., Nweke, R. N., & Attama, D. C. (2024). Antibiotic susceptibility patterns of enteric fever Salmonella isolates in Enugu, Nigeria. *International Journal of Pathogen Research, 13*(4), 64–71.

Marks, F., Im, J., Park, S. E., Pak, G. D., Jeon, H. J., Wandji Nana, L. R., Phoba, M.-F., Mbuyi-Kalonji, L., Mogeni, O. D., Yeshitela, B., Panzner, U., Cruz Espinoza, L. M., Beyene, T., Owusu-Ansah, M., Twumasi-Ankrah, S., Yeshambaw, M., Alemu, A., Adewusi, O. J., Adekanmbi, O., … Rakotozandrindrainy, R. (2024). Incidence of typhoid fever in Burkina Faso, Democratic Republic of the Congo, Ethiopia, Ghana, Madagascar, and Nigeria (the Severe Typhoid in Africa programme): A population-based study. *The Lancet Global Health, 12*(4), e599–e610. https://doi.org/10.1016/S2214-109X(24)00007-X

Okyere, P. B., Abdulai, R. M., Amankwah, J. K., Aboagye, E., Antwi, H. A., & Agyemang, S. (2025). Risk factors for typhoid fever: Systematic review. *JMIR Public Health and Surveillance, 11*, e67544. https://doi.org/10.2196/67544

Samuel, J. C., & Eleke, C. (2024). Prevalence and demographic correlates of typhoid fever among adults treated in health centres in Degema Community, Rivers State, Nigeria. *Journal of Public Health and Toxicological Research, 2*(2), 97–102. https://doi.org/10.60787/jphtr.vol2no2.40

Ugbede, O. J., Okolo, P. N., Ochiaka, D. I., Eze, P. I., Ogbuyeme, J. N., Atuchi, N. M., Nwachukwu, M. C., & Offor, E. C. (2025). Public health implications of internal climate-induced migration: Tracking disease patterns in IDP settlements in Northern Nigeria. *International Journal of Education Research and Scientific Development, 7*(2), 355–373. https://doi.org/10.59795/ijersd.v7i2.237

Widal Test. (2023). *Wikipedia*. https://en.wikipedia.org/wiki/Widal_test

World Health Organization. (2023). *Typhoid*. https://www.who.int/news-room/fact-sheets/detail/typhoid